Space Weather Forecast

Issued on Monday, 25 March 2024 at 01:10 Local

This forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Further Minor/Moderate radio blackouts (R1/R2) expected. Current S1 conditions slowly reducing. Minor to Moderate geomagnetic storms (G1-G2) expected into Day 1 (25 Mar) given CME arrival 24th Mar and ongoing HSS, with a slight chance of Strong geomagnetic storm (G3) intervals at first on Day 1.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was moderate, with the large and complex region near centre disk (AR3615) producing six distinct Moderate class flares through the period. There are now eight sunspots on the visible disc. AR3615 remains by far the largest and most complex group on the disc, showing significant magnetic complexity although perhaps some simplification and consolidation observed in recent hours. Changes in other groups were minor by comparison. Two new sunspot regions have appeared on the disc, a small spot to the south of AR3615 and an as yet unnumbered region which has rotated on the north eastern limb.

UK Aurora Analysis: Despite the strong recent geomagnetic activity, cloudy skies over much of Scotland has caused aurora sightings to be unlikely, with none confirmed at time of writing.

No significant Earth-directed Coronal Mass Ejections (CMEs) observed on available imagery over the last 24hr.

Solar Wind / Geomagnetic Activity: The solar wind was initially at slightly elevated levels but steadily rose to elevated levels, 500-550km/s. A complex CME arrived at the observation satellites at L1 at 24/1410UTC at which point solar winds jumped to strong-very strong speeds (750-850 km/s) where they have remained since. The IMF was initially weak to moderate but jumped to strong values from the CME arrival, briefly touching very strong (~33nT at 25/1606UTC). Bz initially weakly fluctuated -6/+6nT but became strongly negative from CME impact until 25/1548UTC, peaking at -26nT around 25/1510UTC from which point it has largely been strongly positive.

The net result of the above solar wind measures was initially Unsettled to Active activity after a Moderate geomagnetic storm (Kp6) at 24/0000UTC. However from 24/1200UTC conditions returned to moderate geomagnetic storm (Kp6) following the CME arrival, peaking at severe geomagnetic storm (Kp8) from 24/1500UTC, falling to a strong storm (Kp7) at 24/1800UTC and Active (Kp4) from 24/2100UTC.

Energetic Particles / Solar Radiation: Solar radiation was initially above S2 levels, but fell to S1 levels from 22/2012UTC and have been on a slow and steady decline since.

Four-Day Space Weather Forecast Summary

Solar Activity: Moderate to High activity is expected, with further Moderate flares expected from primarily the large and highly active region near centre disk (AR3615) through the forecast period, with a chance of isolated Strong flares.

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Solar Wind / Geomagnetic Activity: A coronal mass ejection (CME) associated with the strong flare on the 23rd March arrived at L1 at 24/1410UTC. Combined with a high speed stream, this is currently giving very strong solar wind speeds. There are no other earth directed CMEs in the forecast.

Wind speeds are expected to remain strong at first on Day 1 (25 Mar) but on a slow and steady decline over the coming days, however there is some uncertainty regarding this decline due to MOSWOC ENLIL underdoing speeds in association with the above mentioned coronal hole over the past 24 hours. Speeds are expected to reduce to background levels through Day 3 (27 Mar) and in the absence of further enhancements remain at background into Day 4 (28 Mar).

Initially geomagnetic activity is expected to give G1-G2 minor to moderate storm conditions to start Day 1 (25 Mar) with a chance of G3 strong geomagnetic storm (Kp7) intervals at first. These conditions expected to slowly ease, becoming Active-G1 by the start of Day 2 (26 Mar), continuing to ease through the day to become unsettled to active with perhaps a slight chance of residual G1 intervals. Through Day 3 (27 Mar) and into Day 4 (28 Mar) a return to generally Quiet to unsettled (Kp0-3) conditions is expected given likely waning of HSS influence and the absence of further CME enhancement.

UK Aurora Forecast: Despite some residual enhancement of geomagnetic activity into the the evening of the 25th March, cloudy conditions across much of Scotland causes any aurora sightings to be unlikely.

Energetic Particles / Solar Radiation: High energy proton flux, as observed by GOES18 has recently reduced from S2 levels to S1 levels. A slow decline is now expected through Day 1 (25 Mar) in the absence of further significant flare activity, perhaps falling back to background levels by later day 2 into day 3 (26-27 Mar), although confidence is reasonably low given the number of different factors as well as the dominant AR3615 making continued progress westward through this four-day period to gradually increase the risk of further enhancement in association with significant flaring.

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Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	70	20	5	5
Strong	G3	Yes	10	1	1	1
Severe	G4	Yes	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	90	90	90	90
Very Active	R3 to R5 X	No	30	30	30	30

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	Yes	100	70	40	30
Very Active	≥ S3 *	No	5	5	5	5

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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